Speaker Abstracts

2005 State-County Ground Water Symposium

September 7, 2005

Keynote Address: A HISTORY OF WATER RESOURCE MANAGEMENT IN MARYLAND

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THE LOCAL HEALTH PERSPECTIVE—SEPTIC SYSTEM FAILURES ON KENT ISLAND

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Queen Anne's County had a significant change in its rural farming-fisheries background when the Chesapeake Bay Bridge was built in 1952.

The western part of the County is an area called Kent Island and had over 9,000 lots platted before there was a Planning and Zoning Office in the County. These "old lots of record" were established with no assessment for adequacy of water and sewerage disposal, storm water management, utility provision or road structure.

Many of these lots were built upon when soil and site evaluations were conducted during anytime of the year and had no review for seasonal high water tables until 1973. Most of the lots have severe limitation for on-site waste disposal due to small lot sizes, inadequate sewage reserve areas, seasonal high water tables, poor surface drainage, and slowly permeable soils.

The Queen Anne's County Health Department has emphasized for over twenty (20) years the necessity for the County to serve these older subdivision areas with public sewer. After numerous sanitary surveys, public informational meetings, individual property decisions, and County Commissioners work sessions the conflict still rages and is debated by those interests against public sewer because of cost and infill growth concerns.

2005 LEGISLATION FOR UNDERGROUND STROAGE TANKS AND MTBE

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Beginning January 26, 2005 the owner of a regulated Underground Storage Tank (UST) system must comply with the new requirements. This presentation will explain the pertinent information for new, replacement, or upgraded and existing UST systems. The new sampling and monitoring requirements will be outlined for UST systems inside areas identified as "High Risk Groundwater Use Areas" as defined by the new regulations.

DRAFT PROTOCOL FOR IDENTIFYING BEST AVAILABLE TECHNOLOGY FOR NITROGEN REDUCING ONSITE SEWAGE DISPOSAL SYSTEMS

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Under the direction of the 2004 Bay Restoration Fund Legislation, the Maryland Department of the Environment (MDE) has been charged with identifying Best Available Technology (BAT) for nitrogen reducing onsite sewage disposal systems (OSDS), in part, to determine conditions for grant funding. A workgroup was formed in January 2005 to develop a protocol for BAT identification and also propose policies and regulation necessary to ensure long-term operation of BAT. The purpose of this talk is to provide an overview of the protocol and the basis for certain details.

ASSESSING MARYLAND'S WATERSHEDS FOR WATER SUPPLY PLANNING

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The May 2004 Final Report of the Governor's Advisory Committee on the Management and Protection of the State's Water Resources concluded with recommendations that are of paramount importance to the vitality of Maryland's economy and to the well-being of its citizens. One of the most important is the need to improve planning at state and local levels to manage and protect water resources as Maryland's economy and population grow. The Advisory Committee's specific recommendations include directing and enabling the Department of the Environment to "Continue conducting ⋯ the statewide evaluation of water supply sources, and repeat the evaluations at regular intervals to ensure consistency with changing demographics and resource conditions." MDE has begun the evaluation process by looking at water resources at the watershed level in the western half of the State. The Catoctin Creek watershed was chosen as the first watershed for evaluation because it met several important criteria, most notably that: 1) Population and water demand have significantly increased in recent years and are expected to continue to increase, and 2) stream gage and other water monitoring data, as well as the results from previous analyses, are available to evaluate the water resources in the watershed. This presentation will summarize the Catoctin Creek project's progress thus far, including evaluation of the available water resources, current and projected demands, and other environmental factors that may affect water availability for future needs.

RADIOLOGICAL TESTING OF DOMESTIC WELLS IN BALTIMORE COUNTY

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Following the announcement by Maryland Department of Environment (MDE) in 1998 that elevated levels of radium were discovered in Coastal Plain wells in the Upper Chesapeake area, Baltimore County (with the Maryland Geological Survey (MGS)) initiated radiological testing of Piedmont Aquifer wells. The results of the MGS study (Report No. S2/RI66) indicated that only 1 of the 46 wells sampled had elevated radium in the ground water. This well was located in the Baltimore Gneiss Aquifer. Follow-up testing in 2003/2004 by Baltimore County of 73 wells in the Baltimore Gneiss indicated that 15% of the wells sampled had short-term Gross Alpha Particle Activity (GAPA) exceeding the U.S. EPA's drinking water standard of 15 pCi/l . In June 2004 Baltimore County began requiring radiological testing for the Certificate of Potability (COP) for all wells located in the Baltimore (and Setters) Gneiss. Homeowner's were encouraged to contact private laboratories to arrange for their wells to be tested for radiological contaminants. To date, Baltimore County has compiled results from over 470 households in the area of concern. Approximately 11% of the wells exceed the U.S. EPA's drinking water standard for GAPA. Specific isotopic testing indicated that that nearly all samples exceeding EPA MCLs were due to radium. Baltimore County is planning to perform additional studies in areas underlain by other gneiss aquifers (Perry Hall, Franklinville, Sykesville, Gunpowder, Slaughterhouse).

PERFORMANCE AND MANAGEMENT OF ADVANCED ONSITE SEWAGE DISPOSAL SYSTEMS

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In the 2004 State Legislative session the Bay Restoration Fund was created to provide funding for the restoration of Maryland's bays. As part of this new program approximately 6.5 million dollars per year will be available to upgrade onsite sewage disposal systems to best available technology (BAT) for nitrogen removal. An important component of BAT and all advanced onsite sewage disposal systems, not specifically addressed by this legislation, is management. This presentation evaluates the performance of large advanced onsite sewage disposal systems and individual advanced onsite sewage disposal and hypothesizes that an appropriate level of management is necessary for these systems to perform as designed.

PROJECT WET MARYLAND

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Project WET Maryland, a part of the Aquatic Resources Education Program within the Maryland Department of Natural Resources, is a multi-faceted water education training program that includes several strands including: Project WET, Healthy Water Healthy People, Conserve Water, River of Words, and Storm Drain Stenciling. Educators of all types are encouraged to attend Project WET Maryland workshops.

- Project WET is a water education program for teachers and non-formal educators that address many water topics such as groundwater, watersheds, water chemistry, water resources management. Curriculum Guide with 92 activities – Grades K-12.

- Healthy Water Healthy People is for anyone interested in learning and teaching about contemporary water quality education topics. Curriculum Guide and Field Testing Guide – Grades 6 through adult education.

- Conserve Water Educator's Guide is a collection of innovative activities and case studies that are easy to use, interactive, challenging, and fun! Conserve Water includes many opportunities for educators to engage participants in exploring the topic of water conservation. Grades 6 through adult education.

- Maryland River of Words—River of Words® is an arts and environmental education program that teaches watershed education through the arts. Maryland has a partnership with River of Words® (www.riverofwords.org) through the Project WET (Water Education

for Teachers) Program. There are both an International River of Words Poetry and Art Contest and a State Contest.

- Storm Drain Stenciling is a service learning activity for your school, community association, 4-H, Scout, or other youth group. Stenciling storm drains in your community may discourage people from putting harmful items and trash in the drains.

MDE'S INITIATIVES FOR WATER SUPPLY PLANNING

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Many communities in Maryland are experiencing unprecedented rapid growth. Adequate water and sewerage systems are necessary in order to support this growth as well as to protect public health and water quality. The County Water and Sewerage Plan sets forth the program and timeline for providing water and wastewater infrastructure in a local jurisdiction. This presentation will review MDE's initiatives to improve the water and sewerage planning process in Maryland as well as review MDE's new guidance for preparing Water and Sewerage Plans. An important aspect of ensuring an adequate water system is determining the overall capacity of the water system, and ensuring that capacity will be available to meet the demands of proposed development. A plan to manage available capacity, including a process to track committed capacity and assess remaining available capacity at the time that development plans are approved, is an indispensable planning tool. The presentation will include a review of MDE's draft guidance document on Water Capacity Management Plans.

CARROLL COUNTY'S APPROVAL METHOD FOR ONSITE SEWAGE SYSTEMS—NITRATE MODEL DEVELOPMENT AND IMPLEMENTATION

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In Carroll County, proposed development using individual onsite sewage disposal systems which would result in groundwater nitrate levels that exceed the drinking water standard of ten parts per million (10 ppm) cannot be approved. A mass-balance approach is used at the time of plan review to evaluate the impact of proposed development on groundwater nitrate levels. The specific model for this determination was selected by Carroll County as being the most appropriate method. The Carroll County Bureau of Environmental Health is the implementing agency for this review. Inputs are specific to the geology and lot configuration of the site under review. Tom Devilbiss, chief of Carroll County Resource Management, will speak about the model itself and Leigh Broderick, supervisor of the Development Plan Review section of the Carroll County Bureau of Environmental Health, will speak about its implementation in the review of proposed subdivisions for the Health Department. Examples will be given of problem sites and their resolution.

IMPROVED REPORTING AND ACCESS TO DOMESTIC WELL WATER QUALITY DATA THROUGH WEB-BASED AUTOMATION

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The Environmental Public Health Tracking Project at MDE is developing a plan to improve electronic management of data from domestic water wells in Maryland. The goal is to enhance the capture, reporting, and access to data through a web-based network involving state and private labs, local health departments, state agencies, and potentially other stakeholders. A 2-year pilot project has been proposed and submitted to EPA for funding. Automated capture of public drinking water data and automated flow of ambient surface water monitoring data to EPA's Exchange Network are also included in the proposal. These enhancements will enhance the quality and timeliness of water quality data.

USE OF SEASONAL WATER BUDGET TIME SERIES TO ASSESS WATER AVAILABILITY IN SUB-BASINS UNDERLAIN BY FRACTURED BEDROCK AQUIFERS

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The upper portion of the Potomac River basin poses a challenge for water availability assessment because of the close interconnection between ground water and surface water resources and the seasonal nature of potential water supply problems in this region. Seasonal water budget time series were constructed for four sub-basin fractured bedrock aquifers in the Monocacy/Catoctin drainage area. Quarterly estimates were made for aquifer discharge (baseflow), recharge, storage, and net ground water withdrawals for the time period, 1960 through 2002. Estimates of the volume of water stored in each sub-basin aquifer, above the level of zero stream discharge, were made using baseflow recession analyses, and these results were found to be in good agreement with available well data. A measure of summertime water availability was defined to be summer (3rd quarter) recharge plus “beginning-of-summer” storage, and a cumulative distribution function of this quantity was examined to estimate summertime availability during periods of drought. Summertime water availability for the four sub-basins, Catoctin Creek, upper Monocacy (above gage at Bridgeport), Big Pipe Creek, and Bennett Creek sub-basins were estimated to be 210, 120, 460, and 420 gpd/acre (gallons per day per acre), respectively for a typical year, but to fall to 60, 30, 150, and 160 gpd/acre, respectively, for a dry year (20-year drought).

APPLICATION OF PENNSYLVANIA'S RESIDENTIAL NITRATE REDUCTION STRATEGY TO THE CENTRAL MARYLAND DEVELOPMENT CORRIDOR; AN ALTERNATIVE TO MANDATED DOMESTIC DENITRIFICATION SYSTEM

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The Commonwealth of Pennsylvania Act 537 requires individual communities to develop and submit plans for nitrate reduction. For residential subdivisions on individual septic systems, commonly this is accomplished through a simple nitrogen mass balance approach, wherein minimum lot size is a function of the area necessary to dilute nitrate concentrations in wastewater percolate to a concentration of 10 milligrams per liter (mg/L) at the downgradient property line(s).

Though Maryland passed the "flush tax" last year in a wholly differing approach to nitrate reduction in the Chesapeake Bay Watershed, nitrate concentrations in groundwater remain of overall concern. We believe that adoption in Maryland of Pennsylvania Act 537 may achieve the goals of nitrate reduction without the economically onerous burden of mandated pretreatment. As an option to pretreatment, lot size could be increased to achieve nitrate reduction through natural dilution.

We examined the effect of the Act 537 minimum lot size approach, if applied in Maryland on residential lot sizes in areas of the Maryland Piedmont outside of public sewer service areas. In so doing, we estimated the minimum lot size required to dilute future wastewater discharges to nitrate concentrations of 10 mg/L at the down-gradient property line, using the Pennsylvania raw percolate criterion of 45 mg/L.

We portrayed the results spatially, superimposed on a map of Howard, Carroll, Frederick and upper Montgomery Counties. The results generally were concordant with our Pennsylvania experiences. Unless denitrification is provided, most areas would require minimum lot sizes of two acres or greater to dilute nitrate with on-site precipitation percolate.

PLANNING, REGULATORY AND DESIGN ASPECTS OF SUBSURFACE INJECTION OF TREATED DOMESTIC WASTEWATER

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This session will introduce participants to the planning, regulatory and design aspects of subsurface injection of treated domestic wastewater with emphasis on the first deep well injection project in Delaware. Included will be a description of the membrane bioreactor technology selected to treat the wastewater prior to injection

WATER-SUPPLY POTENTIAL OF THE AQUIA AND MAGOTHY AQUIFERS IN SOUTHERN ANNE ARUNDEL COUNTY, MARYLAND

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Water use in Southern Anne Arundel County consists primarily of self-supplied domestic use from the Aquia aquifer. The deeper Magothy aquifer

is utilized to a lesser extent as a source for minor public supply (mobile home parks) and irrigation. In 2000, approximately 1.8 and 0.22 million gallons per day were pumped from the Aquia and Magothy aquifers, respectively. Water levels have declined at an average rate of approximately 0.7 feet per year in the Aquia and Magothy aquifers since about 1970. The available drawdown in the Aquia aquifer in 2000 ranged from 0 feet through the central part of Southern Anne Arundel County to 150 feet at Rose Haven. Water levels exceed the management level within a 2-mile-wide band located in the central part of Southern Anne Arundel County. By comparison, available drawdown in the Magothy aquifer in 2000 ranged from approximately 125 feet in the Davidsonville area to 360 feet at Rose Haven. Water demand in Southern Anne Arundel County may increase to a total of 2.8 million gallons per day by 2020 to support the growing population. The Aquia and Magothy aquifers are the most likely sources for future withdrawals, although deeper aquifers in the Potomac Group are also available. Through use of a numerical ground-water-flow model of the Aquia and Magothy aquifers it was determined that if future demand was supplied by the Aquia aquifer the increased withdrawals combined with increased withdrawals to the south will cause water levels in the Aquia aquifer to decline by as much as 22 feet. A significant part of the drawdown results from pumping in Calvert County. The Aquia aquifer can supply the projected 2020 water demand without depleting the available drawdown in most of Southern Anne Arundel County. However, water levels exceed the management level (as currently defined) in a band as much as 3.5 miles wide extending from Waysons Corner to Rhode River. Constraining the use of the Aquia aquifer in Southern Anne Arundel County, the Mayo-Edgewater area and Calvert County will reduce drawdown in Southern Anne Arundel County. If future use is supplied by the Magothy aquifer, the increased withdrawals combined with regional withdrawals will cause water levels in the Magothy aquifer to decline about 20 feet by 2020. The Magothy aquifer can supply the projected increase in water demand through either individual residential wells or public-supply wells without a significant reduction in available drawdown. However, greater drilling depths, treatment costs for the removal of iron, and the

practicality and expense of centralized public-water systems are important considerations related to its use. Water levels in the Aquia aquifer will not be affected by the increased pumpage from the Magothy aquifer.

MARYLAND SPRAY IRRIGATION SYSTEM AND NITROGEN REMOVAL

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Spray irrigation of treated wastewater is one of the alternatives for wastewater disposal. The benefits include further purification of wastewater by soil and crops as well as reuses and recycling of water resource and nutrients. While wastewater is moving through the soil profile, advanced treatment of wastewater also is taking place. Treatment mechanisms such as soil filtration of solids and microorganisms, soil adsorptions of trace elements and crop uptake of nutrients are involved to remove pollutants from wastewater prior to entering the groundwater system.

There are a total of 32 existing spray irrigation systems in Maryland. Of these existing spray irrigation systems, 6 systems are golf course turf irrigations and the remaining 26 systems are agricultural irrigations on the crops or grass. Spray irrigation of treated wastewater is regulated under COMAR 26.08.02.09 (Groundwater Water Quality Standards) and a State Groundwater Discharge Permit is required. Sites approved for spray irrigation must meet the soil and groundwater table requirements specified in the *Maryland Department of the Environment Guidelines for Land Treatment of Municipal Wastewaters.* Wastewater must be pretreated to meet either Class I or Class II (higher quality) effluent limitations prior to spray irrigation.

Buffer zone to minimize aerosol effect caused by spray irrigation is necessary. Two tiers of buffer zone requirements are applicable depending on effluent quality. Groundwater monitoring wells are required to be installed around the spray field for assessing the impact of groundwater quality from a spray irrigation system.

Impact of nitrogen to groundwater quality caused by spray irrigation must be evaluated thoroughly prior to system approval. The evaluation includes conducting a nitrogen balance to ensure that nitrogen in the treated wastewater will not cause the groundwater quality to exceed the drinking water standard of 10 mg/l or to increase nitrogen loads to an adjacent stream, if any, which is already impaired by nutrients.

In this presentation, limiting factors including effluent limitations, spray irrigation rate, buffer zone and nitrogen balance, which may affect the approval process of a spray irrigation system, will be discussed. Operational records of a Maryland spray irrigation system also will be presented.

STATISTICAL ANALYSIS OF BALTIMORE COUNTY WELL DATA

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Baltimore County sought the assistance of the Towson University Applied Math Lab to evaluate the domestic well data in an effort to better understand where and why wells yields diminish (or fail) in Piedmont aquifers. Variables affecting well yield that were considered included well construction, geology, number of dry holes, well depth, and static water

level. A variety of statistical methods were utilized to assess correlation and significance from a dataset of approximately 21,000 wells. Results indicate that nearly 75% of replacement wells were replacing water supplies constructed prior to 1980 (when new well construction regulations were promulgated). Less than 5% of all replacement wells had 1 or more unsuccessful drilling attempts (dry holes). The wells in the Loch Raven Schist had the lowest average well yield (6.5 gpm) while the wells in the Cockeyville Marble had the highest average well yield (12.6). The wells in the Loch Raven Schist had the deepest average well depth (320 feet), while the Granite wells had the shallowest average well depth (218 feet). Analysis of well yield failure rate by geology indicated that wells in the Loch Raven Schist had only a slightly higher chance (11%) of failing than did wells in the Cockeysville Marble (10%) and Gneiss (10%). The report concluded that well yield was the most influential variable for predicting well failure. Static water level was significant although not of great influence on predicting well failure. Well depth was not found to be significant in predicting well failure.

EVALUATION OF THE GROUND-WATER SUPPLY IN SOUTHERN MARYLAND

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Rapidly growing populations in Calvert, Charles, and St. Mary's Counties have placed significant stress on the aquifers used for water supply in the tri-county area. Future population projections indicate that the stress on these aquifers may increase dramatically in the next several decades. A study was conducted of the water-supply potential of the aquifer system in Southern Maryland, and a ground-water flow model was developed that simulates water levels in the five major aquifers in this area

The flow model was calibrated using historical pumpage and water levels, and was then used to estimate future water levels through 2030 based on future pumpage scenarios compiled in conjunction with county planning departments.

Projected water demand in Calvert and St. Mary's Counties through 2030 could be met by increased pumpage in the Aquia aquifer (without shifting withdrawals to deeper aquifers) without reducing water levels below the 80-percent management level. Shifting a portion of public-supply withdrawals from the Aquia aquifer to the Upper Patapsco aquifer would result in an increase in available drawdown in the Aquia aquifer in many areas of the counties, with minimal effects on drawdowns in the outcrop area in Charles County.

In Charles County, the proximity of the major pumping centers to the outcrop/recharge areas of the Patapsco aquifers, and the relatively shallow depth of the aquifers limit their productive capabilities. Withdrawals from the Magothy aquifer in the Waldorf area cannot be increased significantly above 2002 amounts without lowering heads below the 80-percent management level by 2030. Simulated future drawdowns indicate the potential for river-water intrusion into the Upper Patapsco and Lower Patapsco aquifers from the Potomac River in the Indian Head area. Simulated drawdowns also indicate the potential in shallow portions of the Patapsco aquifers for reduced base flow to streams and a lowered water table, which could reduce the amount of water available in some types of wetlands. These issues could not be specifically addressed in the context of a large regional study, but require additional examination. Alternative water-supply options should be evaluated in Charles County, such as utilizing the Patuxent aquifer, or replacing current production well fields with new wells in the Patapsco aquifers farther southeast.

AUTOMATED MAINTENANCE AND MONITORING OF ADVANCED ONSITE TREATMENT SYSTEMS

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It has long been recognized that advanced onsite wastewater treatment systems significantly improve effluent quality, primarily of biochemical oxygen demand, total suspended solids, and/or nutrients over that of conventional systems. However, advanced systems require routine maintenance to deliver this superior performance. In the past regulators have lacked an effective means of monitoring maintenance, leading to questions of proper system performance. NSF International has aided this process for many years with its certification of advanced treatment systems whereby service is required for the first two years. NSF takes on the responsibility of ensuring this service through contractual obligations with the system manufacturers, and assessed through field inspections. NSF has now expanded its support of the regulatory community by providing a means to measure this for the life of the system, applicable to certified and non-certified systems. To be both cost-effective and convenient, this extended support will take the form of a web-based, database monitoring program that utilizes inexpensive telemetry. It enables regulators, service providers, and homeowners to monitor the service and alarm status of onsite wastewater treatment systems for the life of the system through simple computer access to the web, real-time email and phone communications. NSF has designed the system primarily for use with advanced onsite treatment systems, however the program also features many convenient uses for recording and tracking information related to conventional systems, either with or without the telemetry component. This program will be of particular benefit for the implementation of the Bay Restoration Fund in the field monitoring of onsite systems.

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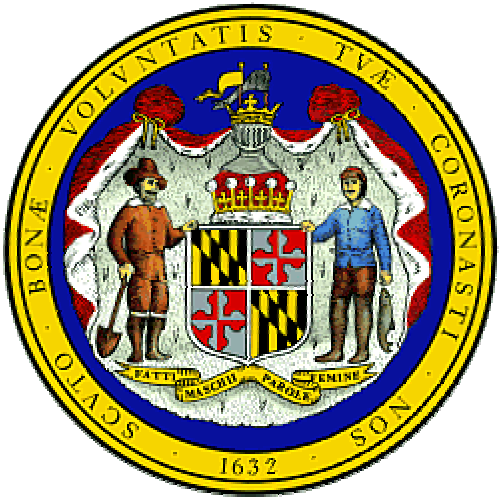

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